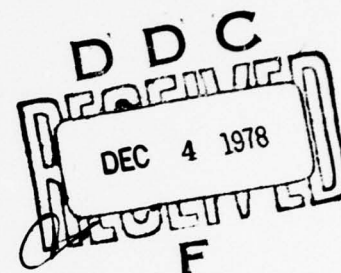# DECISION MAKING
RESEARCH

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DECISION MAKING RESEARCH

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THE EFFECT OF DECISION TASK
CHARACTERISTICS ON DECISION BEHAVIOR[1]

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Contingency Model for Decision Strategy Selection		Complexity
Nonanalytic	Decision Maker Characteristics	Irreversibility
Unaided-Analytic	Decision Problem	Significance
Aided-Analytic	Decision Environment	Accountability
Task Characteristics	Unfamiliarity	

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

Three experiments were conducted to examine the contributions of various aspects of decision tasks to people's selection of strategies for making the required decisions. The variables of interest were derived from a recently published contingency model for decision strategy selection. The first experiment was essentially a pilot study and established that it was possible to do profitable research in the area. The second experiment yielded the relative contributions of the independent variables to strategy selection. The independent variables were unfamiliarity and complexity of the decision problem, irreversibility and

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20. significance of the decision, and accountability of the decision maker. The results supported the viability of the model. The third experiment showed that decision makers' perceptions of the relative contributions of the variables of interest are roughly congruent with the empirical relative contributions obtained in the second experiment.

The Effect of Decision Task Characteristics on Decision Behavior[1]
Marcia Deaton Huffman
University of Washington

Casual observation has shown that people use a variety of strategies for making decisions and that the strategies they use are sometimes suboptimal. A large amount of research has been aimed at developing decision aids to improve effectiveness. While improved effectiveness is an important goal, understanding decision behavior as it is is also important. Informal interviews I conducted with people in urban transportation, health care, government, and city planning revealed that people have a number of best strategies and that they do not consistently use their one "best." Instead of searching for the one all around best strategy, perhaps, we, like these decision makers, should be looking for good matches of strategies and problems-- i.e., upon what variables is a strategy's perceived appropriateness contingent?

This idea of contingencies (i.e., a match between individuals and problems) is prevalent in some areas of psychology. A number of contingency models have been developed for organizational psychology. For example, Fiedler and Chemers (1974) have proposed a contingency model of leadership effectiveness. Effectiveness is seen as contingent on the leadership style (measured by a questionnaire about the leader's least preferred co-worker, or LPC) and the situational favorableness, consisting of the leader-member relations, the task structure, and the leader's position power. Fiedler and Chemers found that a task oriented leadership style (low LPC) was effective when the situational favorableness was very high (i.e., good leader-member relations, a structured task, and high position power) or very low (i.e., poor leader-member relations, an unstructured task, and low position power).

On the other hand, in situations that were mildly favorable or mildly unfavorable, a relationship oriented style (high LPC) was effective. They concluded that there is no universally effective leadership style; rather, each style's effectiveness is contingent upon the task and environmental circumstances.

Similarly, Woodward (1965) concluded that there is no one best way of organizing a business. In a study of approximately 100 British firms, the organizational structure that was best was found to be contingent on productive technology. She divided technology into three broad groupings: (1) small batch and unit production (e.g., custom tailoring), (2) large batch or mass

production (e.g., electronics components), and (3) process or continuous production (e.g., oil refining). Woodward found that unit production was associated with a low degree of control and low predictability of results, and process production was associated with a high degree of control and high predictability of results. Those firms that used management practices suited to the production techniques were more successful economically than firms whose management styles did not suit their production technology.

Lawrence and Lorsch (1969) also studied the contingent nature of organization design. Of prime importance in their theory is the interplay between any major part of an organization and its relevant external environment. Another important factor in their model is the predisposition of the organization's members. The fit of the organizational structure with both the external environment and the internal factor of employee's predispositions helps determine unit performance (measured on a number of dimensions, including profitability). Lawrence and Lorsch studied three industries coping with different environments. They studied the fit of the organizational characteristics and the environmental conditions and found that in a diverse and dynamic field (e.g., the plastics industry), organizations need to have a high degree of corroboration (i.e., high integration) among units that have different goal and time orientations (i.e., high differentiation) to be effective. A more stable and less diverse environment (as in the container industry) requires organizations to have less differentiated units that are highly corroborative (integrated) if they are to be effective. Lawrence and Lorsch pointed out that in many complex, multi-unit organizations there are different relevant environments with different demands. They therefore recommended an integrating unit and various conflict resolution practices to contribute to the organization's overall performance.

Lawrence and Lorsch described several implications of their contingency theory for the design of effective organizations. For example, they proposed that the search for optimal levels of differentiation and integration must begin with a diagnostic study of the organization and its immediate environment, including an examination of the tasks, attributes, and environments of each unit. According to Lawrence and Lorsch, the effectiveness of the process of conflict resolution depends on its fit with the degrees of differentiation and integration, and the selection of discrete management practices (e.g.,

payment systems) must also be geared to the task and environment of each unit.

There have been a few contingency models in decision psychology. One, Friedman and Segev (1977), studied the decision to decide--i.e., whether to face or ignore a decision problem. They suggested that the decision to decide is contingent upon the average profit per unit of top management time spent on the specific type of decision problem. Each type of decision problem was characterized by the outcome to the organization facing the problem and the length of time the decision making process focuses on that type of problem. If the goal of top management is to maximize profits per unit of time, the optimal strategy would be to accept decision problems if the average profit for that type of problem is greater than or equal to the maximum possible average profit per unit of top management time for the given spectrum of potential decision problems. What Friedman and Segev have done is offer a decision strategy, with its accompanying process and decision rule (maximization of profits per unit of time), for deciding whether or not to make a decision.

Nutt (1976) proposed another contingency model of decision making in organizations. He described six organizational decision models and the organizational and environmental conditions under which each model would be optimal. The models were organized by the type of systems logic they used. In a closed system, it is assumed that the key variables in the decision task are either known or knowable, and decision making is deterministic, analytic, and proactive. On the other hand, decision making in an open system is adaptive, reactive, and adjusts to feedback information. Selection of the optimal model is contingent upon the dependencies among the organizational units and layers (technological, managerial, and institutional), the tasks of each unit (categorized by their variability and analyzability), performance assessment required between adjacent layers, and environmental characteristics.

Another less general contingency model for decision psychology was proposed by Payne (1976). On the basis of studying information processing techniques of subjects in various decision situations, he concluded that processing technique selection is contingent on task complexity. The four strategies included in Payne's experiments were the additive, conjunctive, additive difference, and elimination-by-aspects models. In using the

additive model, each alternative is decomposed into dimensions, each dimension is given a value, and the values are combined in an additive fashion yielding an overall value for each alternative. The overall values of the alternatives are then compared and the one with the greatest value is chosen. The additive strategy is compensatory (i.e., high values on one dimension can compensate for low values on another), interdimensional, and involves a constant pattern of information search (i.e., the decision maker searches a constant amount of information per alternative). In using the conjunctive model (Einhorn, 1970; Dawes, 1964), an alternative must have a certain minimum value on all the relevant dimensions in order to be chosen. It is a non-compensatory, interdimensional model, and it involves a variable pattern of search (i.e., more dimensions are searched for some alternatives than for others).

The additive difference model (Tversky, 1969) calls for the decision maker to compare alternatives directly on each dimension, determine the difference, and sum the results to reach a decision. In multi-alternative choice situations, the decision maker could compare an alternative to the better of the two in the preceding comparison. The additive difference model is compensatory, intradimensional, and involves a constant pattern of search. The decision maker using the elimination-by-aspects (EBA) strategy (Tversky, 1972) selects an attribute and eliminates all alternatives not possessing that attribute. The process is repeated until only one alternative remains. It is assumed that the probability of selecting a dimension or attribute is proportional to its relative importance. The EBA model is non-compensatory, intradimensional, and involves a variable pattern of search.

Payne, unlike many decision researchers, views the four models as complementary. In his experiments, the subjects' strategy choices were studied as a function of the number of alternatives available and the number of dimensions available per alternative. He found that ". . . as the number of available alternatives increases, subjects shift from decision strategies involving a constant amount of search per alternative, e.g., compensatory procedure, to decision strategies which involve eliminating some alternatives on the basis of only a few dimensions, e.g., conjunctive or elimination-by-aspects procedures." (p. 383)

Thus far, then, the decision to decide has been shown to be contingent on the average profit per unit of top management time, and decision strategy

selection has been shown to be contingent on internal characteristics of the organization in which the decision is made, the organization's external environment, and the complexity of the task. Beach and Mitchell (in press) have proposed a new contingency model for the selection of decision strategies. In their model, strategy selection is contingent upon the characteristics of both the task and the decision maker. This paper describes three studies designed to test several hypotheses derived from this new contingency model. Table 1 shows a graphic representation of the model and the variables comprising it.

Insert Table 1 about here

Strategies

Strategies have been divided into three categories: aided-analytic, unaided-analytic, and nonanalytic.

Aided-analytic. In using these strategies, the decision maker must use a tool of some sort (e.g., paper and pencil, a calculator, or a computer) in a systematic analysis of the decision and the evaluation of its components. The use of these strategies requires training or invention, and a technician is frequently employed to help.

Examples of aided-analytic strategies are decision analysis and the normative models in economics, statistics, and operations analysis. According to Raiffa (1968), decision analysis involves the construction of a decision flow diagram or decision tree of the problem that shows in chronological order the moves that the decision maker may choose and those that are governed by chance. The tree also shows the costs and payoffs for following any branch to its end and the probability assessments of the various branches at each chance fork. The decision maker uses a process called "averaging out and folding back" to determine how to exercise his or her partial control in the problem. The decision maker calculates the expected monetary value (EMV) at any fork by multiplying the payoff by the probability for each branch and summing the products for the branches. The path with the highest EMV is selected and all other paths are blocked off.

Unaided-analytic. The decision maker using one of the unaided-analytic strategies attempts to explore the components of the decision problem but
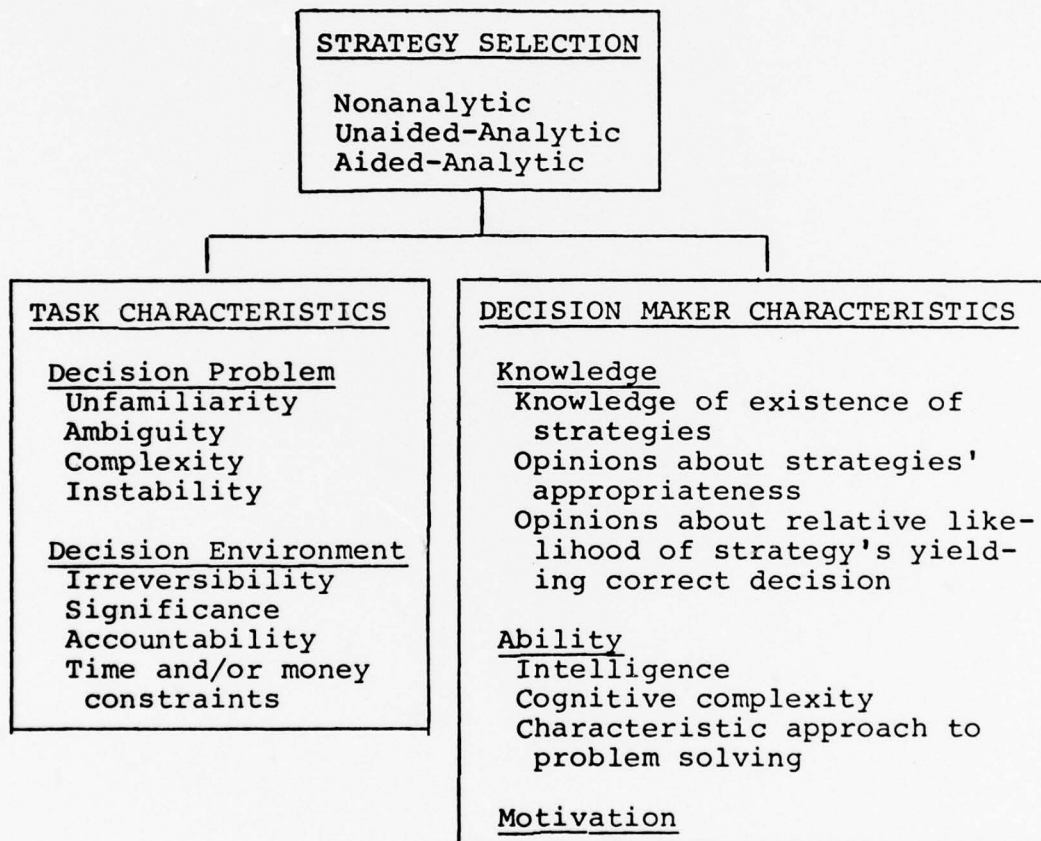
uses no tools--i.e., information processing is limited to the confines of his or her mind.

Approximations to subjective expected utility (SEU) that decision makers perform in their heads fall into this category. SEU is similar to decision analysis in that it focuses on probabilities and payoffs of outcomes associated with various alternatives. However, the decision maker's subjective probabilities replace the objective probabilities used in decision analysis, and the market values of the payoffs are replaced by the decision maker's utilities, or subjective values for the payoffs. In an aided-analytic application of SEU, for each alternative the decision maker estimates the likelihood of each outcome, multiplies it by its utility, sums across the outcomes, and then selects the alternative with the highest sum. In an unaided-analytic application of SEU, the decision maker merely thinks about the possible outcomes of the available choices and the chances of those occurring, and then selects the alternative that seems to offer the best potential. Gray (1975) found that students' decisions to attempt arithmetic problems of varying difficulty could be predicted by SEU, and Holmstrom and Beach (1973) showed that college students' relative preferences for occupations could be accounted for on the basis of the relative magnitudes of the associated SEU's. The unaided-analytic category also includes the additive, conjunctive, and EBA strategies described earlier. As Payne (1976) found, these strategies require different amounts of information processing on the part of the decision maker. The additive difference model involves the comparison of only two alternatives at a time and therefore information processing is simpler using this strategy than it is using SEU. The non-compensatory strategies (conjunctive and EBA) require even less information processing. The least formalized strategy involves the construction of mental movies or scripts (Abelson, 1975). The decision maker imagines vignettes, or mental pictures, of actions and outcomes associated with each alternative. A series of two or more of these vignettes constitutes a script. A script is imagined for each alternative and the alternative with the best script is chosen.

Nonanalytic. Nonanalytic strategies involve preformulated rules that are rotely applied to decision tasks. In general they require little information procurement and processing, little time, and no decomposition of the problem.

Table 1

Contingency Model for Decision Strategy Selection

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┌─────────────────────────────┐
│ STRATEGY SELECTION          │
│                             │
│   Nonanalytic               │
│   Unaided-Analytic          │
│   Aided-Analytic            │
└─────────────────────────────┘
```

TASK CHARACTERISTICS

Decision Problem
  Unfamiliarity
  Ambiguity
  Complexity
  Instability

Decision Environment
  Irreversibility
  Significance
  Accountability
  Time and/or money
   constraints

DECISION MAKER CHARACTERISTICS

Knowledge
  Knowledge of existence of
   strategies
  Opinions about strategies'
   appropriateness
  Opinions about relative like-
   lihood of strategy's yield-
   ing correct decision

Ability
  Intelligence
  Cognitive complexity
  Characteristic approach to
   problem solving

Motivation

Some nonanalytic strategies are flipping a coin and homiletic rules such as "Better safe than sorry" or "Nothing ventured, nothing gained" used as the basis of a decision. Other nonanalytic strategies are habit and compliance with convention.

The major differences among these strategy categories are the degree of analysis required and thus the amount of resource expenditure required. Because aided-analytic strategies involve formal procedures and often require much information procurement, they can be quite costly in terms of time and effort. Unaided-analytic strategies require some decomposition of the problem, but because they are limited to unaided human information processing capabilities, their cost is likely to be lower than the cost of using an aided-analytic strategy. Nonanalytic strategies require little analysis beyond verification that the rule is applicable to the present task. They are likely to be quick and require little resource expenditure.

An important similarity among the categories is that, within each category the strategies can be ordered from formal to informal. It is assumed that, as aided-analytic strategies require more resource expenditure than unaided and nonanalytic ones, formal strategies have higher resource requirements than informal strategies. According to the model, the choice of strategy with high resource requirements is attributable to the characteristics of both the task and the decision maker. Beach and Mitchell state that people resist expenditure of what these authors call "personal resources:" time, effort, and/or money. People try to expend the least personal resources compatible with the demands of the decision task. This resistance is not thought to be laziness. Instead, there may be many demands on the decision maker's time and energy, the decision maker may need to appear quick and decisive, and the emotional need to get the matter settled may be very strong for some people.

Characteristics of the Decision Task

Task characteristics are defined as the decision maker's perception of the demands and constraints of the specific task at hand. As Table 1 shows, there are two types of task characteristics that contribute to strategy selection--those inherent in the decision problem, and those that describe the decision environment.

Decision problem. Some of the characteristics that differentiate decision problems are unfamiliarity, ambiguity, complexity, and instability. According to the model, the demand of the decision problem (D_{dp}) is the

weighted (W) sum of the problem's unfamiliarity (Uf), ambiguity (Am), complexity (C), and instability (Is),

$$D_{dp} = W_{Uf}Uf + W_{Am}Am + W_C C + W_{Is}Is.$$

High D_{dp} represents a high demand for a strategy that will help clarify a difficult problem.

Decision environment. Situational factors that influence strategy selection include irreversibility, significance, accountability of the decision maker, and time and/or money constraints. The demand of the decision environment (D_{de}) is the weighted (W) sum of the decision's irreversibility (Ir), significance (S), and the decision maker's accountability (Ac),

$$D_{de} = W_{Ir}Ir + W_S S + W_{Ac}Ac.$$

High D_{de} represents a demand for a strategy that will yield a correct decision.

Task demand (TD) is the weighted (W) sum of the demands of the decision problem (D_{dp}) and the decision environment (D_{de}),

$$TD = W_{dp}D_{dp} + W_{de}D_{de}.$$

Some combinations of task variables present relatively simple selection problems. For example, a decision task might involve a decision problem that is highly unfamiliar, highly ambiguous, highly complex, and highly unstable, and the environment might dictate high irreversibility, high significance, and high accountability. The decision maker is likely to perceive the situation as uncomfortable and demanding and would want to structure things and protect him or herself by using the best available strategy--probably the most formal analytic strategy he or she could use.

Some cases present more complex selection problems. There may be high problem demands (i.e., an unfamiliar, ambiguous, complex, and unstable problem) but a comfortable environment (i.e., reversibility exists and significance and accountability are low). In this case, the problem demand suggests an analytic strategy but the environment does not. A possible solution to the selection problem is, "Since the decision is not very important, why should I spend a lot of time trying to analyze this difficult and complex problem?"

Characteristics of the Decision Maker

This category includes personal characteristics of the decision maker that are not situation-specific. Table 1 shows some of the characteristics that may influence strategy selection. They include knowledge, ability, and motivation.

Beach and Mitchell describe two decision makers. A is intelligent, knowledgeable about decision strategies, cognitively complex, and given to systematic analytic thinking. A, then, has the ability to use aided-analytic strategies with acceptable resource expenditure and thus has access to all three categories of strategies. His opposite, $\overline{A}$, is of moderate or low intelligence, cognitively noncomplex, given to wholistic unanalytic thinking, and has little or no knowledge of aided-analytic strategies and only a sketchy appreciation of the more formal unaided-analytic strategies but believes that they lead to greater decision accuracy than the less formal ones. To conserve personal resources, $\overline{A}$ would probably favor the less formal unaided-analytic and nonanalytic strategies. When A and $\overline{A}$ select strategies from the same category, it is likely that A's choice would be more formal than $\overline{A}$'s.

The Model

According to the proposed contingency model, "strategy selection is viewed as a compromise between the press for more decision accuracy as the demands of the decision task increase and the decision maker's resistance to the expenditure of his or her personal resources" (Beach & Mitchell, in press).

In general, the hypotheses of this model can be divided into three categories: those concerned with the task, those concerned with the decision maker, and those concerned with the relationship between the task and the decision maker.

Task Hypotheses

(1) The decision maker's utility for making a correct decision (U_c) is an increasing monotonic function of the demand of the decision environment (D_{de}).

(2) For a given strategy, the probability of a correct decision (P_c) is a decreasing monotonic function of the demand of the decision problem (D_{dp}). In general, analytic and formal strategies are perceived as having a higher P_c than nonanalytic and informal ones.

Decision Maker Hypotheses

(3) The decision maker's disutility for personal resource expenditure ($\overline{U}_e$) is an increasing monotonic function of the amount of expenditure.

(4) The cost of resources ($\overline{U}_e$) is a positively accelerated function of P_c. Because less analytic strategies are quicker and easier than analytic ones, they have, on the average, a lower cost.

Task-Decision Maker Hypotheses

(5) For a given level of D_{dp}, all strategies in a decision maker's repertory can be evaluated in terms of P_c and the estimate of $\overline{U}_e$.

(6) For a given level of U_c associated with a given level of D_{de}, the tendency of selecting strategies of ever increasing P_c is checked by $\overline{U}_e$. That is, the difference between the expected benefit ($P_c U_c$) and the expected cost ($\overline{U}_e$) is the expected net gain. The strategy that maximizes net gain will be selected.

(7) Environmentally imposed time and money constraints exclude from consideration those strategies that require a high degree of analysis. Thus, strategies with a high P_c are most likely to be excluded. This may force selection of a strategy that yields less than the maximum expected gain.

At this time only a few studies about this model have been done. McAllister (1978) tested the effects of decision environment variables and found that the experimental situation and the type of subjects used affect the strengths of the decision environment variables irreversibility, significance, and personal accountability. The findings of the Christensen-Szalanski and Beach (1977) and Christensen-Szalanski (1977) experiments support the hypotheses that people use a form of cost-benefit analysis (maximization of expected net gain) as a basis for selecting decision strategies.

In this paper, three studies designed to test various hypotheses derived from the model are described. The first experiment looks at the effects of task environment variables on (1) the amount of resource expenditure perceived as necessary to solve a decision problem, and (2) the judged appropriateness of various decision strategies. Experiment 2 involves both problem and environment variables and was designed to determine their effects on estimates of probability of being correct, the utility of being correct, the cost, and the appropriateness of informal and formal strategies. Experiment 3 examined subjects' own perceptions of the relative importance of the task variables used in the second experiment.

Experiment 1

This first experiment was conducted to determine whether it is feasible
to study the effects of Beach and Mitchell variables (in this case accounta-
bility, significance, and irreversibility) on the subjects' judgments of the
appropriateness of decision strategies from each of the three categories
described by Beach and Mitchell. In addition, the experiment looked at the
effects of these variables on the amounts of time, effort, and analysis judged
to be required to solve each of eight decision problems.

Method

Forty introductory psychology and business students at the University of
Washington were paid for their participation in this experiment. All the
subjects were run in a group in a one hour session. They were presented
with descriptions and examples of three decision strategies: Rule of Thumb
(nonanalytic), Decision by Scenario (unaided-analytic), and Decision Tool
(aided-analytic). After the subjects read the descriptions, the experimenter
gave an oral explanation of the strategies and answered subjects' questions.

Rule of Thumb was described as the application of homiletic rules or
intuition based on a "gut level" reaction instead of careful analysis. The
only analysis required was in selecting the appropriate rule of thumb--i.e.,
making sure the rule fit the decision problem. Examples given included
"Better safe than sorry" and "Nothing ventured, nothing gained." Rules of
thumb that applied directly to the decision problems in the experiment (e.g.,
"Quality, not quantity") were not included to avoid any possible bias in
favor of this strategy.

Decision by Scenario was described as imagining a mental movie or script
of the actions and outcomes associated with each alternative and selecting
the alternative with the best script. This strategy was based on Abelson's
(1975) work described earlier.

Decision Tool was essentially an aided-analytic application of maximization
of SEU. This strategy was described as decomposing each decision alternative
into possible outcomes and judging the probability that the outcome will occur
and the value or importance of that outcome. For each alternative, the
probabilities are multiplied by the values of the outcomes, and the products
are summed. The alternative with the highest sum is selected.

The subjects were then asked to read eight scenarios of decision problems,
assuming the role of the decision maker in each problem. Then, using 100-point

scales, they were asked to judge the appropriateness of using a Rule of Thumb, Decision by Scenario, and Decision Tool for each problem. In addition, they were asked to use three more 100-point scales to judge the amount of time, effort, and analysis necessary to solve each decision problem. Appendix A contains a sample scenario and its corresponding scales.

Each of a series of scenarios described a hypothetical decision problem of one of eight hypothetical businesses. There were two levels (absent and present) of each of three independent variables: accountability, significance, and irreversibility. Each of the scenarios contained a different combination of the three independent variables. Thus, all possible combinations of 2 levels of accountability x 2 levels of significance x 2 levels of irreversibility = 8 different scenarios. Each subject received a packet of eight scenarios-- one for each firm. Order of experimental conditions and assignment of conditions to firms were counterbalanced to control for presentation order effects and intrinsic differences among the firms.

Business directories and case studies from business texts were consulted in the writing of the scenarios. The firms and decision problems were selected both for their interest value and their plausibility. It was feared that the subjects would get bored reading eight scenarios and might not pay very much attention to their task. Therefore, most of the businesses were somewhat unusual--e.g., a firm of golf course architects, an armored car service, and a frozen food producer. The decision problems, however, were fairly typical of the types of decisions businesses might face--e.g., whether to move to a new office or remain in the same location, whether to buy out a competitor or maintain the status quo, and which of two employees to lay off.

The manipulations of irreversibility, significance, and accountability were presented as part of the scenario. Irreversibility was manipulated by allowing the decision maker (subject) to change his mind at some later time (i.e., the decision is temporary and can be reversed later) or by making the decision permanent (the company must live with the choice, regardless of the outcome). Significance was manipulated by varying the decision's impact on the financial status of the company or an individual. Accountability was manipulated by making the decision maker personally responsible for the outcome of the decision (he will have to justify his decision to a superior) or not personally responsible (no one will expect him to justify his decision).

The hypotheses were:

(1) Appropriateness of the degree of formality of a strategy is an increasing function of the demands of the task environment. That is, it was expected that the analytic strategies (Decision by Scenario and Decision Tool) would be judged more appropriate than Rule of Thumb when the decision maker was held accountable and when the decision was irreversible and significant. It was also expected that the judged appropriateness of Rule of Thumb would increase when the decision maker was not held accountable and the decision was reversible and unimportant.

(2) The amounts of time, effort, and analysis necessary to solve the decision problem are increasing functions of the demands of the task environment. It was expected that irreversible and significant problems and problems for which the decision maker was held accountable would be perceived as requiring more time, effort, and analysis to solve than reversible, unimportant problems for which the decision maker was held accountable.

Results

A 40 x 2 x 2 x 2 analysis of variance with the last three repeated measures was computed for each of the dependent variables: appropriateness of the Rule of Thumb, Decision by Scenario, and Decision Tool, and the amount of time, effort, and analysis judged to be required to solve the problem.

Appropriateness ratings. The analysis of variance of the appropriateness judgments showed that accountability, significance, and irreversibility had no significant main effects on subjects' appropriateness ratings of the Rule of Thumb, Decision by Scenario and Decision Tool strategies. However, an inspection of the overall means showed that the Rule of Thumb was considered least appropriate ($\overline{X}$ = 35.5), Decision by Scenario was considerably more appropriate ($\overline{X}$ = 62.3), and Decision Tool was most appropriate ($\overline{X}$ = 64.3).

Time. Both significance and irreversibility affected subjects' judgments of the amount of time necessary to solve the decision problem (Table 2). Significance ($F(1,39)$ = 22.3, p = .00) and irreversibility ($F(1,39)$ = 14.9, p < .01) each accounted for 12% of the total variance. As expected, time judgments were higher for significant decisions ($\overline{X}$ = 64.60) than for not significant ones ($\overline{X}$ = 55.99) and higher for irreversible decisions ($\overline{X}$ = 64.63) than for reversible ones ($\overline{X}$ = 55.96). There were no significant interactions.

Insert Table 2 about here

Effort. The results were similar for subjects' judgments of the amount of effort required to solve the decision problem (Table 2). Again, significance affected these judgments (F(1,39) = 16.7, p < .01) and accounted for 8% of the total variance. Effort judgments were higher for significant decisions ($\overline{X}$ = 66.88) than for unimportant ones ($\overline{X}$ = 59.91). The analysis also showed a main effect for irreversibility (F(1,39) = 15.5, p < .01). Irreversibility accounted for 6% of the total variance. Effort judgments, as expected, were higher when the decision was irreversible ($\overline{X}$ = 66.48) than when it was reversible ($\overline{X}$ = 59.31). Again, only main effects were significant.

Analysis. A similar pattern of results was found in the subjects' judgments of the amount of analysis required to solve the decision problem (Table 2). Both significance and irreversibility affected these judgments. Significance (F(1,39) = 5.6, p < .02) accounted for 6% of the total variance, and irreversibility (F(1,39) = 4.8, p < .03) accounted for 3%. Again, as expected, analysis judgments were higher for significant decisions ($\overline{X}$ = 67.48) than for unimportant ones ($\overline{X}$ = 60.41) and higher for irreversible decisions ($\overline{X}$ = 66.64) than for reversible ones ($\overline{X}$ = 61.24).

Difficulties with Experiment 1 made some of the results unclear. In discussing the categories of strategies with some of the subjects, the experimenter discovered that many of them viewed Rule of Thumb as generally inappropriate for any business decision, regardless of the stated level of importance, irreversibility, and accountability. However, when the experimenter suggested some rules of thumb directly applicable to the scenarios, the subjects agreed the rules were applicable and sometimes appropriate. Thus, it became clear that subjects were ignoring Rule of Thumb and were seriously considering only two strategies. It was necessary for the second experiment to clarify the attributes of the strategies and make the decision problems more general in nature.

Experiment 2

Method

Experimental materials consisted of "bare bones" descriptions of decision problems, their environment, and the types of strategies used to solve the problems. To avoid some of the difficulties of Experiment 1, no problem content, or "cover story" was included. Instead, each decision problem was described simply as familiar or unfamiliar to the decision maker and as

Table 2

Results of the Analysis of Variance of Time,

Effort, and Analysis Ratings: Experiment 1

	Source of Variation	SS	df	MS	F
Time	Importance	5925.40	1	5925.40	22.3**
	Subjects x Importance	10355.22	39	265.52	
	Reversibility	6011.78	1	6011.78	14.9**
	Subjects x Reversibility	15753.35	39	403.93	
Effort	Importance	5088.05	1	5088.05	16.7**
	Subjects x Importance	11875.70	39	304.51	
	Reversibility	4118.45	1	4118.45	15.5**
	Subjects x Reversibility	10340.30	39	265.14	
Analysis	Importance	4004.45	1	4004.45	5.6*
	Subjects x Importance	27933.55	39	716.25	
	Reversibility	2332.80	1	2332.80	4.8*
	Subjects x Reversibility	18925.70	39	485.27	

*$p < .05$

**$p < .001$

simple or complex. The situation or environment was such that the decision
was irreversible or reversible, significant or insignificant, and the decision
maker was either accountable or not accountable for the outcome of the
decision. The strategy selected to solve the problem was either informal or
formal. Appendix B is an example of a task in which the decision problem
(D_{dp}) is unfamiliar and simple; the decision environment (D_{de}) dictates that
the decision is reversible and significant, and the decision maker is not
accountable for the outcome of the decision; and the strategy the hypothetical
decision maker has selected to solve the problem is informal.

Examples of informal and formal strategies were described in both the
written and oral instructions given to subjects. The informal strategy
described involves the construction of mental movies or scripts of how the
decision maker imagines things might be if one or another alternative were
chosen. The decision maker then selects the alternative for which the
script turns out the best. The formal strategy described involves listing
and evaluating outcomes that could occur if each decision alternative were
chosen. The given example was about a Seattle condominium firm's suggestion
that customers use a five-point scale to rate the importance of each of
several categories of condominium characteristics (e.g., location, size, and
age of building). Then they are encouraged to visit different condominia
and evaluate each, again on a five-point scale, in terms of the categories
of these characteristics. For each condominium, the evaluation ratings are
multiplied by the importance ratings, and the products are summed. The
condominium with the highest sum is the recommended purchase.

It was decided that a test of the model should include both decision
problem and decision environment variables. The decision problem variables
are unfamiliarity, complexity, instability, and ambiguity. Because the task
descriptions in this experiment are static, it was thought that a variable
involving change over time (i.e., instability) would be difficult to describe
adequately and possibly confusing to the subjects. Therefore, instability
was not included in the experiment. Ambiguity was also excluded because,
despite its being defined in the model as different from complexity, the two
are quite similar and subjects might have confused them. Thus, the problem
variables tested were unfamiliarity and complexity.

The decision environment variables are irreversibility, significance,
accountability, and time and/or money constraints. The last variable was not

included because theoretically it overrides all the other variables (Beach & Mitchell, in press). Any possible effects of the problem and environment variables would be eliminated or at least reduced if time and/or money to solve the problem were very scarce. Thus, irreversibility, significance, and accountability were the decision environment variables tested.

The 2 unfamiliarity levels x 2 complexity levels x 2 irreversibility levels x 2 significance levels x 2 accountability levels x 2 strategies yields 64 decision task descriptions. Each task description constituted a page (Appendix C) in a booklet that was given to each participant in the experiment. The pages of each booklet were scrambled to control for presentation order effects.

The 50 University of Hawaii business students who participated in the study read each set of decision task descriptions and judged (1) how valuable it was (i.e., what the utility was) for the decision maker to be correct in solving the problem using the strategy that was used, (2) the probability that the decision maker was correct in solving the problem using that strategy, (3) the cost in time, money, and effort to solve the problem using that strategy, and (4) how appropriate the chosen strategy was for solving the problem. A 100-point probability scale was used on which .00 represented "Certain he was wrong" and 1.00 represented "Certain he was correct." The value or utility ranged from 1 ("Doesn't matter") to 6 ("Very valuable to be correct"), the cost ranged from 1 ("Very little") to 10 ("Very much"), and the appropriateness scale ranged from 0 ("Not at all appropriate") to 20 ("As appropriate as it needs to be").

The hypotheses were:

(1) The decision maker's _utility_ for making a correct decision is an increasing function of the demand of the decision environment. That is, it was expected that the judged utility for being correct would be higher when the environment dictated irreversibility, significance, and accountability, than when the problem was reversible, unimportant, and the decision maker would not be held accountable.

(2) For a given strategy, the judged _probability_ of a correct decision using that strategy is a decreasing function of the demand of the decision problem. It was expected that judged probability of being correct using a given strategy would be lower when the decision problem was unfamiliar and complex than when it was familiar and simple.

(3) In general, analytic and formal strategies are perceived as having a higher probability of being correct than nonanalytic and informal ones. Thus, it was expected that, given the same problem and environmental conditions, judged probability of being correct would be higher for the formal strategy than for the informal one.

(4) Judged cost is an increasing function of the demands of both the decision problem and environment. It was expected that the perceived cost would be higher for problems that were unfamiliar and complex than for familiar and simple ones. It was also expected that judged cost would be higher when the environment dictated irreversibility, significance, and accountability than when the decision was reversible, insignificant, and the decision maker would not be held accountable.

(5) Formal strategies have a higher cost than informal ones. Thus, it was expected that judged cost would be higher when the formal strategy was used than when the informal one was used.

(6) The judged appropriateness of the degree of formality of a strategy is an increasing function of the demands of the decision problem. It was expected that the judged appropriateness of the formal strategy would be higher for unfamiliar and complex problems than for familiar and simple ones. It was also expected that the judged appropriateness of the informal strategy would be higher for familiar and simple problems than for unfamiliar and complex ones. In addition, it was anticipated that the judged appropriateness of the formal strategy would be higher than that of the informal strategy when the problem was unfamiliar and when it was complex. Further, it was expected that the judged appropriateness of the informal strategy would be higher than that of the formal strategy when the problem was familiar and when it was simple.

(7) The judged appropriateness of the degree of formality of a strategy is an increasing function of the demand of the decision environment. That is, it was expected that the judged appropriateness of the formal strategy would be higher when the decision was irreversible, significant, and the decision maker was held accountable than when the decision was reversible, insignificant, and the decision maker was not held accountable. In addition, it was expected that the judged appropriateness of the informal strategy would be higher when the decision was reversible, insignificant, and the decision

maker was not held accountable than when the decision was irreversible, significant, and the decision maker was held accountable. It was also expected that the judged appropriateness of the formal strategy would be higher than that of the informal strategy when the decision was irreversible, significant, and the decision maker was held accountable. Finally, it was anticipated that the judged appropriateness of the informal strategy would be higher than that of the formal strategy when the decision was reversible, insignificant, and the decision maker was not held accountable.

Results

A 50 x 2 x 2 x 2 x 2 x 2 x 2 analysis of variance with the last six repeated measures was computed for each of the dependent variables: judged utility for being correct, judged probability of being correct, judged cost, and judged appropriateness.

Because the results of the analyses of variance were very similar for these four variables, intercorrelations were computed. These correlations ranged from .16 to .44, and it was concluded that subjects perceived the four variables as different.

Utility. The analysis of variance of the judged utility for being correct showed that the decision environment affected the utility for making a correct decision (Table 3). There were strong main effects for irreversibility, (ω^2 = .06), significance (ω^2 = .18) and accountability (ω^2 = .18). In addition, complexity (a problem variable) and strategy affected subjects' judgments of the value of being correct, although the F values were considerably smaller than for the environmental variables. Complexity accounted for only .002% of the variance and strategy accounted for .01%.

- - - - - - - - - - - - - - - -
Insert Table 3 about here
- - - - - - - - - - - - - - - -

As the demand of the decision environment increased, the utility for making a correct decision also increased (Hypothesis 1). Figure 1 shows that judged utility for being correct was higher when the environment variables were irreversible ($\overline{X}$ = 4.16), significant ($\overline{X}$ = 4.41) and accountable ($\overline{X}$ = 4.40) than when they were reversible ($\overline{X}$ = 3.49), not significant ($\overline{X}$ = 3.25) and not accountable ($\overline{X}$ = 3.26). Utility also increased when simple problems ($\overline{X}$ = 3.77) became complex ($\overline{X}$ = 3.89) and when formal strategies ($\overline{X}$ = 3.96) were used instead of informal ($\overline{X}$ = 3.70) ones.

Table 3

Results of the Analysis of Variance of the

Utility for Being Correct

Source of Variation	SS	df	MS	F
Strategy (P)	54.11	1	54.11	23.82**
Subjects x Strategy	111.31	49	2.27	
Complexity (C)	12.02	1	12.02	7.88*
Subjects x Complexity	74.72	49	1.53	
Irreversibility (R)	359.46	1	359.46	80.98**
Subjects x Irreversibility	217.49	49	4.44	
Significance (I)	1082.64	1	1082.64	118.55**
Subjects x Significance	447.50	49	9.13	
Accountability (A)	1035.47	1	1035.47	218.68**
Subjects x Accountability	232.02	49	4.74	
C x I	3.36	1	3.36	4.94*
S x C x I	33.35	49	.68	
P x C	3.97	1	3.97	7.18*
S x P x C	27.11	49	.55	
R x A	9.45	1	9.45	9.91*
S x R x A	46.73	49	.95	
I x A	26.99	1	26.99	21.05**
S x I x A	62.83	49	1.28	
P x U x R	1.90	1	1.90	4.33*
S x P x U x R	21.44	49	.44	
R x I x A	6.58	1	6.58	6.74*
S x R x I x A	47.82	49	.98	

*p < .05

**p < .001
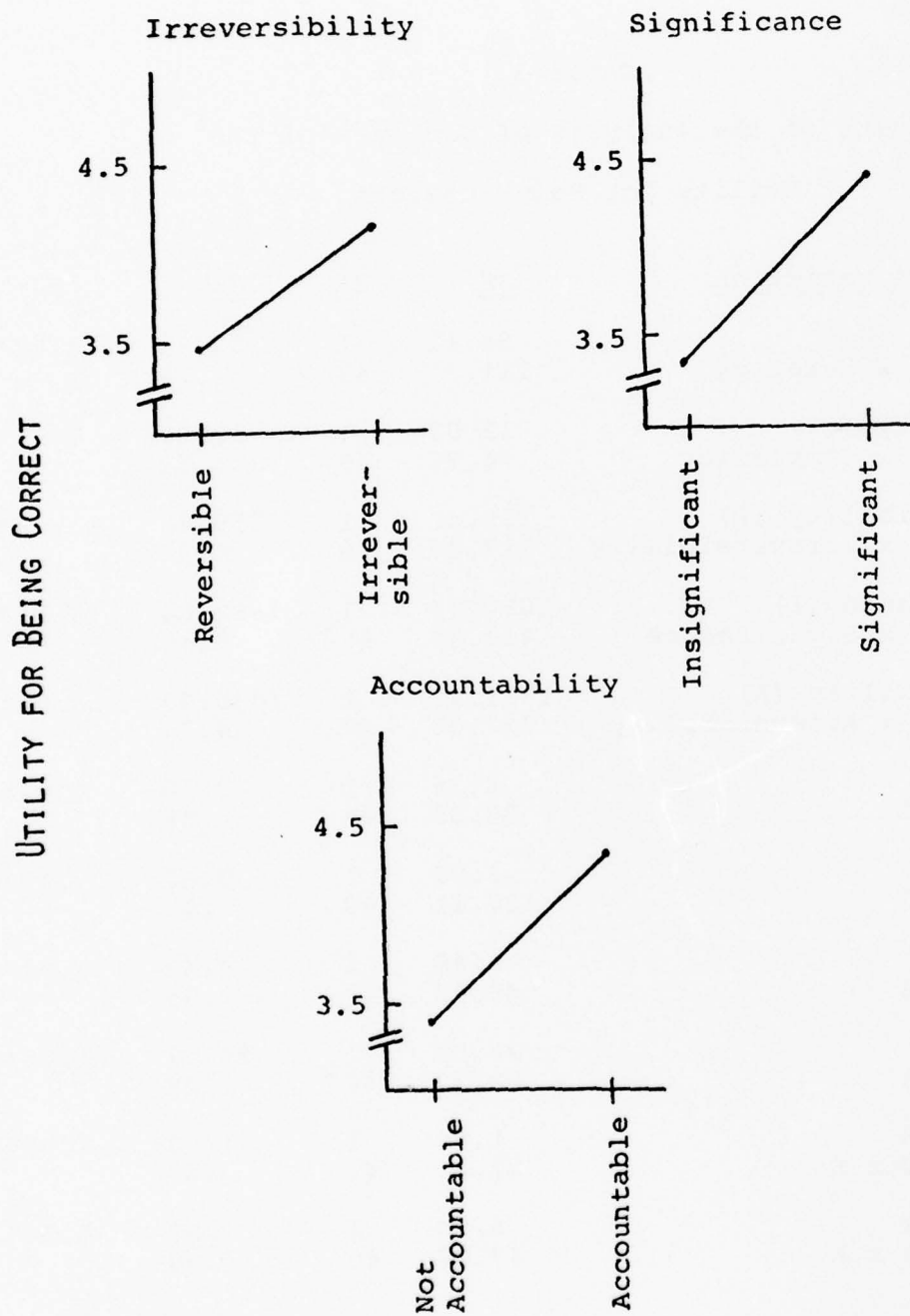
Figure 1. Utility for being correct as a function of environment demands.

Insert Figure 1 about here

Several two-way interactions were also significant--e.g., strategy x complexity, complexity x significance, irreversibility x accountability, and significance x accountability. Two three-way interactions--irreversibility x unfamiliarity x strategy and irreversibility x significance x accountability-- also were significant. These two- and three-way interactions were not predicted in Hypothesis 1, and although they were statistically significant, none accounted for even 1% of the total variance.

These results strongly support Hypothesis 1 that the decision maker's utility for making a correct decision is an increasing function of the demand of the decision environment. Although some decision problem variables and interactions were also significant, they accounted for so little variance that they could hardly be thought to invalidate the model.

Probability. Table 4 shows that, in the analysis of variance of the judged probability of being correct, both unfamiliarity and complexity (the problem variables) as well as strategy yielded highly significant main effects (Hypotheses 2 and 3). Figure 2 shows that judged probability of being correct was higher when the problem was familiar ($\overline{X}$ = .70) and simple ($\overline{X}$ = .70) than when it was unfamiliar ($\overline{X}$ = .59) and complex ($\overline{X}$ = .59). In addition, judged probability of being correct was higher when a formal strategy was used ($\overline{X}$ = .71) than when an informal strategy was used ($\overline{X}$ = .58). Significance and accountability were significant effects, although they accounted for only .003% and .011%, respectively, of the total variance while unfamiliarity and complexity each accounted for 6% and strategy accounted for 8%. The effects of the problem and environmental variables on the probability of being correct were conditional on the strategy selected. Interactions between strategy and unfamiliarity, strategy and complexity, strategy and irreversibility, and strategy and significance were significant (Figure 3). Formality of the strategy selected had a greater positive effect on probability estimates when (1) the problem was unfamiliar, (2) the problem was complex, (3) the decision was irreversible, and (4) the problem was significant.

Insert Table 4 about here

Insert Figures 2 and 3 about here

Individual comparisons of the means showed that in general the judged probability of correctly solving problems was higher for formal strategies than for informal ones. However, the judged probability of correctly solving familiar and simple problems using an informal strategy was the same as the judged probability of correctly solving unfamiliar and complex problems using a formal strategy. The results of the comparisons supported Hypotheses 2 and 3 and several were significant using Duncan's multiple range test. However, because they account for only a small percentage of the variance, specific significance test results are of little value. The interactions of unfamiliarity x complexity and unfamiliarity x irreversibility were also significant. However, these interactions, along with the significant three-way interactions of strategy x unfamiliarity x complexity and strategy x unfamiliarity x significance, each accounted for less than 1% of the total variance.

These findings offer strong support of Hypothesis 2 that for a given strategy, the judged probability of a correct decision is a decreasing function of the demand of the decision problem. Although some of the decision environment variables and interactions were significant, the problem variables, as predicted, accounted for far more variance. The results also support Hypothesis 3 that in general, analytic and formal strategies are perceived as having a higher probability of being correct than nonanalytic and informal ones.

Cost. The analysis of variance of the cost judgments showed that all of the problem and environment variables in this experiment significantly affected subjects' judgments of the cost of solving the problem (Table 5). Figure 4 shows that cost estimates were higher when the strategy was formal ($\overline{X}$ = 6.68) than when it was informal ($\overline{X}$ = 4.37); when the decision problem was unfamiliar ($\overline{X}$ = 5.70) and complex ($\overline{X}$ = 5.92) than when it was familiar ($\overline{X}$ = 5.35) and simple ($\overline{X}$ = 5.13); and when the environment variables were irreversible ($\overline{X}$ = 5.71), significant ($\overline{X}$ = 5.56) and accountable ($\overline{X}$ = 5.81) than when they were reversible ($\overline{X}$ = 5.34), not significant ($\overline{X}$ = 5.19) and not accountable ($\overline{X}$ = 5.19). The variable strategy alone accounted for approximately 25% of the total variance (Hypothesis 5).

Table 4

Results of the Analysis of Variance of the

Judged Probability of Being Correct

| Source of Variation	SS	df	MS	F
Strategy (P)	13.52	1	13.52	48.86**
Subjects (S) x Strategy	13.56	49	.28	
Unfamiliarity (U)	10.48	1	10.48	64.41**
S x U	7.98	49	.16	
Complexity (C)	9.91	1	9.91	90.89**
S x C	5.35	49	.11	
Significance (I)	.59	1	.59	11.00*
S x I	2.61	49	.05	
Accountability (A)	2.07	1	2.07	18.08**
S x A	5.60	49	.11	
P x U	2.36	1	2.36	27.86**
S x P x U	4.16	49	.08	
P x C	3.99	1	3.99	32.10**
S x P x C	6.10	49	.12	
U x C	.17	1	.17	4.79*
S x U x C	1.75	49	.04	
P x R	.31	1	.31	9.92*
S x P x R	1.55	49	.03	
U x R	.08	1	.08	5.31*
S x U x R	.73	49	.01	
P x I	.29	1	.29	5.73*
S x P x I	2.45	49	.05	
C x A	.10	1	.10	4.23*
S x C x A	1.17	49	.02	
P x U x C	.33	1	.33	10.86*
S x P x U x C	1.50	49	.05	
P x U x I	.10	1	.10	5.63*
S x P x U x I	.86	49	.02	

*p < .05

**p < .001
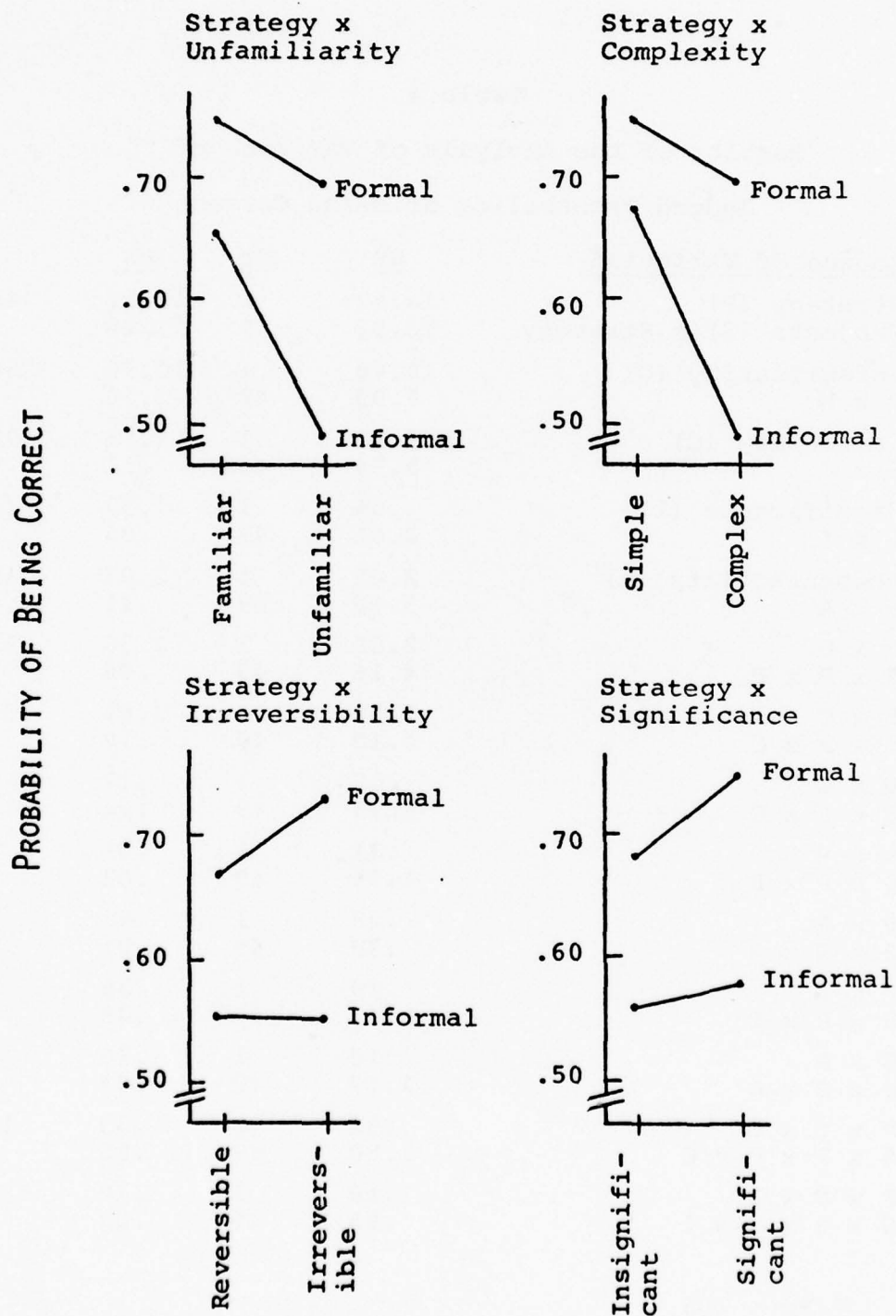
Figure 2. Effects of decision problem and environmental variables on probability, conditional on strategy
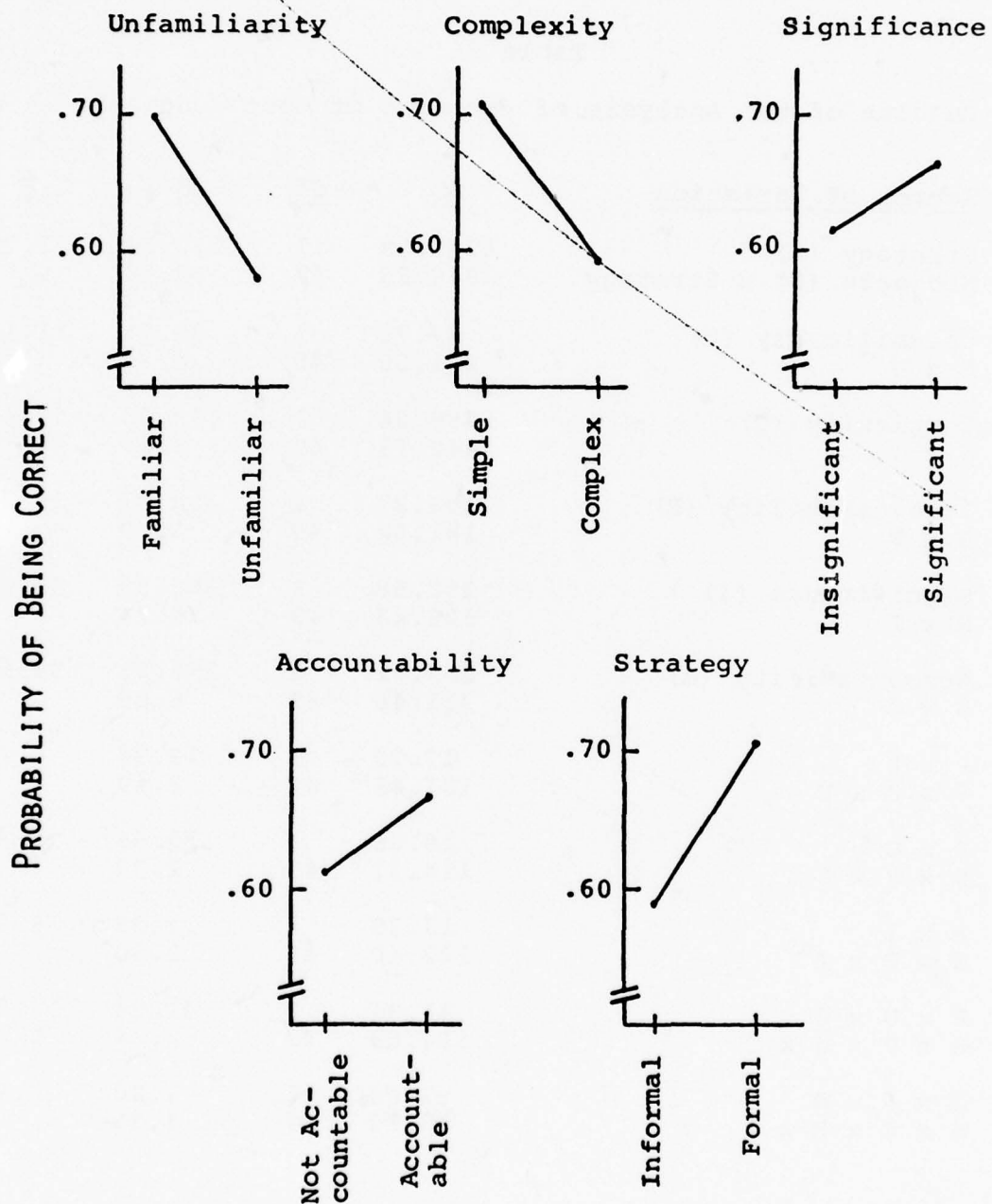
Figure 3. Judged probability of being correct as a function of problem demands, environment demands, and strategy selected.

Table 5

Results of the Analysis of Variance of Cost Judgments

Source of Variation	SS	df	MS	F
Strategy (P)	4272.58	1	4272.58	73.70**
Subjects (S) x Strategy	2840.83	49	57.98	
Unfamiliarity (U)	99.76	1	99.76	21.11**
S x U	231.50	49	4.72	
Complexity (C)	489.06	1	489.06	53.40**
S x C	448.73	49	9.16	
Irreversibility (R)	108.27	1	108.27	29.23**
S x R	181.52	49	3.70	
Significance (I)	358.58	1	358.58	33.38**
S x I	526.43	49	10.74	
Accountability (A)	259.81	1	259.81	39.60**
S x A	321.46	49	6.56	
P x U	13.70	1	13.70	6.25*
S x P x U	107.45	49	2.19	
P x C	19.56	1	19.56	8.38*
S x P x C	114.37	49	2.33	
R x I	17.38	1	17.38	6.96*
S x R x I	122.40	49	2.50	
P x U x C	41.04	1	41.04	17.54*
S x P x U x C	114.68	49	2.34	
C x R x A	7.90	1	7.90	5.94*
S x C x R x A	65.13	49	1.33	

*$p < .05$

**$p < .001$

Insert Table 5 about here

Insert Figure 4 about here

Several two-way interactions also were significant, including strategy x unfamiliarity, strategy x complexity, and irreversibility x significance. Again, each of these interactions accounted for less than 1% of the total variance.

Again, these results support Hypothesis 4 that cost judgments are an increasing function of the demands of both the decision problem and the environment, and Hypothesis 5 that formal strategies have a higher cost than informal strategies.

Appropriateness. An analysis of variance of the appropriateness ratings showed that both the decision problem and the decision environment variables affected those ratings (Table 6). The strategy selected, unfamiliarity, complexity, significance, and accountability were all strong main effects. The effect of irreversibility, however, was not statistically significant. Figure 5 shows that formal strategies were rated high when the demands of the problem and environment were high and rated low when the decision problem and environment demands were low (Hypotheses 5 and 7). Conversely, informal strategies were rated low when the decision problem and environment demands were high and were rated high when the demands were low. The two-way interactions involving strategy (i.e., strategy x unfamiliarity, strategy x complexity, strategy x irreversibility, strategy x significance, and strategy x accountability) together account for 25% of the total variance.

Insert Table 6 about here

Insert Figure 5 about here

Individual comparisons of means using Duncan's multiple range test showed that the formal strategy was seen as significantly more appropriate than the informal strategy when the problem was complex ($\overline{X}$ = 13.89 vs. $\overline{X}$ = 8.25, $p < .05$), when the decision was irreversible ($\overline{X}$ = 12.91 vs. $\overline{X}$ = 10.01, $p < .05$), and when

the decision maker was held accountable ($\overline{X}$ = 13.29 vs. $\overline{X}$ = 10.24, p < .05).
The differences in judged appropriateness of the informal and formal strategy
for familiar and simple problems and insignificant decisions were in the
direction predicted but were not significant.

These results support Hypotheses 6 and 7 that the judged appropriateness
of the degree of formality of a strategy is an increasing function of the
demands of both the decision problem and the decision environment. This
support is especially clear in Figure 5, which shows the two-way interactions
of strategy and the problem variables and strategy and the environment
variables.

Experiment 2 was designed to determine what, if any, effect various
problem, environment, and strategy variables have on subjects' judgments of
(1) the probability that the decision maker was correct in solving the problem,
(2) how valuable it was for the decision maker to be correct in solving the
problem, (3) the cost in time, money, and effort to solve the problem, and
(4) how appropriate the chosen strategy was for solving the problem. The
results of Experiment 2 suggested a number of possible relationships among
the decision problem and decision environment variables. For example, of the
decision problem variables, unfamiliarity accounted for more of the variance
of the appropriateness judgments than did complexity, and of the decision
environment variables, accountability accounted for slightly more of the
appropriateness judgments than did significance. In addition, the problem and
problem x strategy interactions accounted for more of the variance than did
the environment and environment x strategy interactions. These results
suggested that people behave as though the decision problem and decision
environment variables contribute different amounts to strategy selection.
A third experiment was designed to determine if people's perceptions of the
relative importance of these variables are consistent with their behavior
observed in Experiment 2. That is, is accountability perceived as more
important than irreversibility in describing the decision environment? When
selecting a strategy, do people consider the decision environment to be more
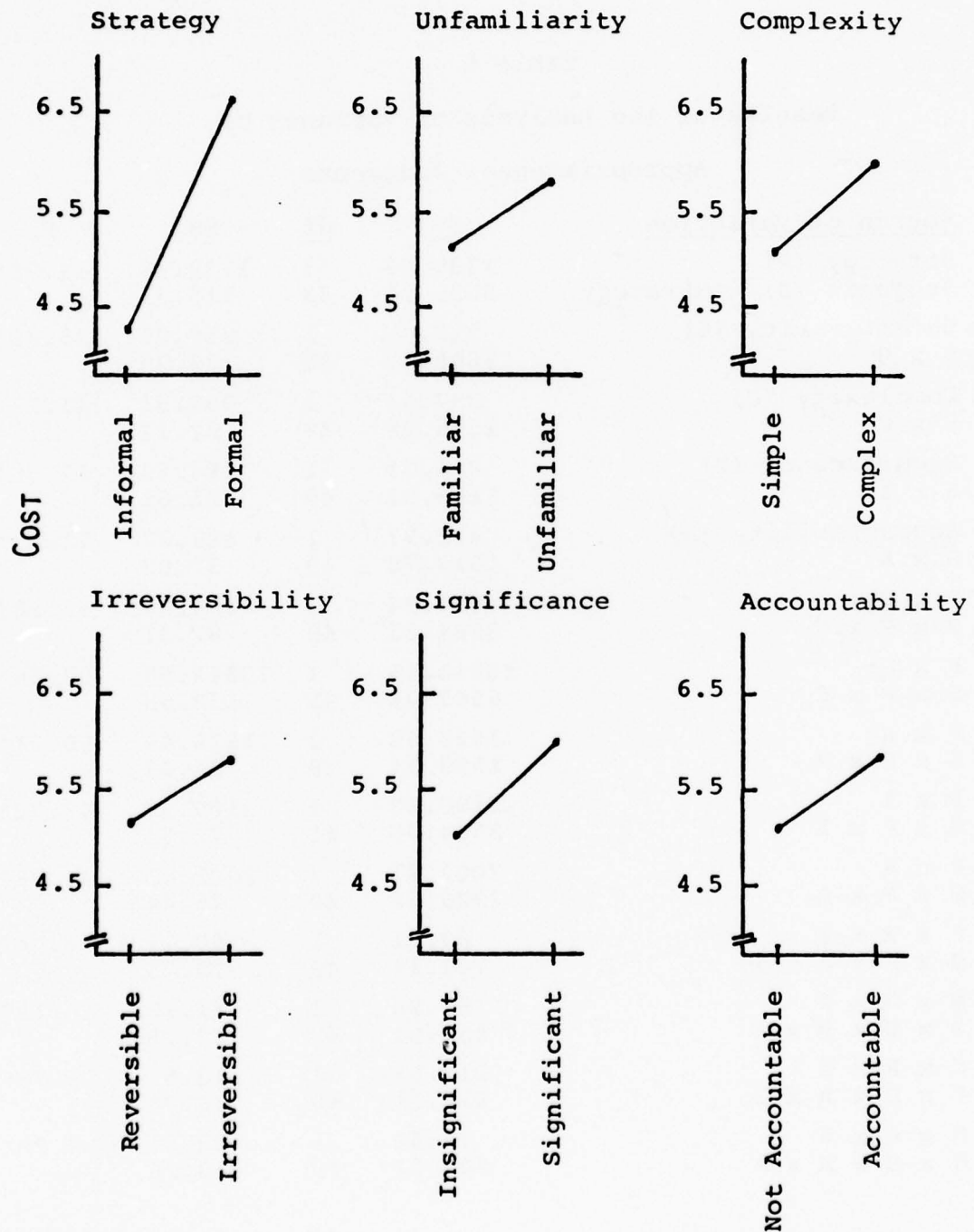important than the decision problem?

Figure 4. Cost as a function of strategy selected, decision
problem demands and decision environment demands.

Table 6

Results of the Analysis of Variance of

Appropriateness Judgments

| Source of Variation	SS	df	MS	F
Strategy (P)	1739.62	1	1739.62	15.08**
Subjects (S) x Strategy	5653.95	49	115.39	
Unfamiliarity (U)	519.06	1	519.06	15.83**
S x U	1606.57	49	32.79	
Complexity (C)	357.51	1	357.51	11.11*
S x C	1576.38	49	32.17	
Significance (I)	284.53	1	284.53	11.56*
S x I	1205.91	49	25.61	
Accountability (A)	422.97	1	422.97	11.43*
S x A	1813.78	49	37.02	
P x U	4494.94	1	4494.94	55.28**
S x P x U	3984.35	49	81.31	
P x C	13843.65	1	13843.65	103.66**
S x P x C	6543.74	49	133.55	
P x R	1628.49	1	1628.49	50.21**
S x P x R	1589.14	49	32.43	
P x I	3180.83	1	3180.83	43.72**
S x P x I	3564.05	49	72.74	
P x A	2002.81	1	2002.81	44.08**
S x P x A	2226.52	49	45.44	
P x R x I	69.21	1	69.21	4.54*
S x P x R x I	747.11	49	15.25	
U x R x I	81.28	1	81.28	6.12*
S x U x R x I	650.61	49	13.28	
C x R x I	113.55	1	113.55	6.78*
S x C x R x I	820.31	49	16.74	
C x R x A	73.81	1	73.81	7.20*
S x C x R x A	502.64	49	10.26	

*p < .05

**p < .001
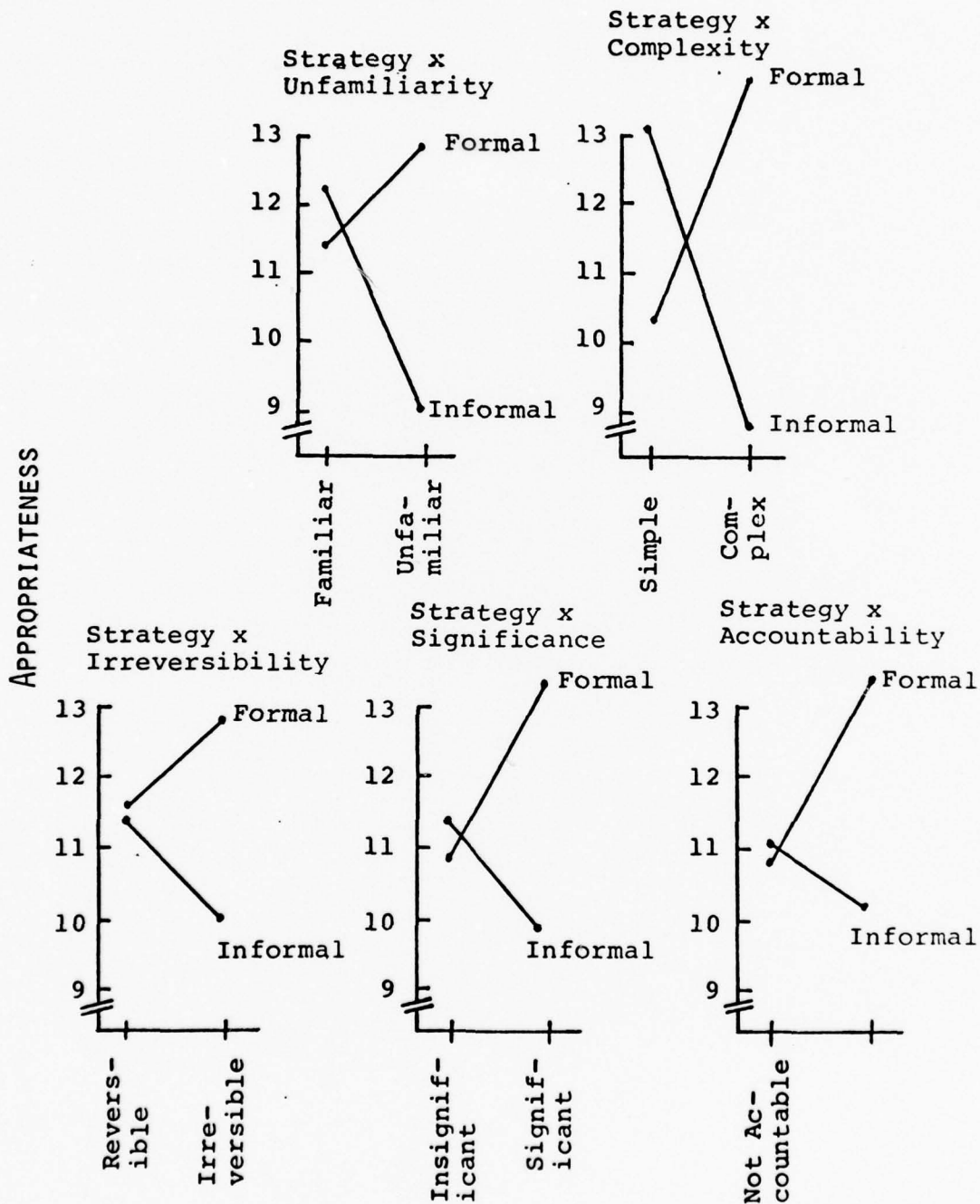
Figure 5. Effects of strategy x unfamiliarity, strategy x complexity, strategy x irreversibility, strategy x significance and strategy x accountability on appropriateness judgments.

Experiment 3

Method

The experimental materials used in this experiment were much the same as those used in Experiment 2. That is, the problem was described as unfamiliar or familiar and as simple or complex. The environment was described as irreversible or reversible, significant or insignificant, and the decision maker was either accountable or not accountable for the outcome of the decision. However, unlike Experiment 2, this experiment did not include any strategy descriptions. The 2 unfamiliarity levels x 2 complexity levels x 2 irreversibility levels x 2 significance levels x 2 accountability levels yield 32 task descriptions. As in Experiment 2, each set of descriptions constituted a page (Appendix D) in a booklet that was given to each participant, and the pages of each booklet were scrambled to control for presentation order effects.

Based on the information provided about the five factors described for each of the 32 task descriptions, a new group of 50 University of Hawaii business students estimated the relative importance of the factors by dividing 100 points among them. As can be seen in the material in Appendix D, participants "spent" 100 points on unfamiliarity and complexity to reflect their judgment of the relative importance of the two factors to the decision problem. They divided another 100 points among the environmental factors irreversibility, significance, and accountability to show the relative weights of the environmental variables. A third set of 100 points was divided between the decision problem and the decision environment to show how important subjects thought the two categories were to the overall selection of a decision strategy. This method of establishing relative weights has been used in a number of experiments (e.g., Beach, Townes, Campbell, & Keating, 1976; Page, 1974).

Based on the findings of Experiment 2, it was hypothesized that:

(1) Of the decision problem variables, unfamiliarity is perceived as more important than complexity. That is, it was expected that the mean importance weight of unfamiliarity would be greater than the mean importance weight of complexity.

(2) Of the decision environment variables, accountability is perceived as more important than significance, which is perceived as more important than irreversibility. It was expected that the mean importance weight of

accountability would be greater than that of significance, which would be greater than that of irreversibility.

(3) The decision problem is perceived as more important to strategy selection than is the decision environment. That is, it was expected that the mean importance weight of the decision problem would be greater than the mean importance weight of the decision environment.

Results

Unfamiliarity and complexity. The mean estimated weights of unfamiliarity and complexity were 51.76 and 48.18, respectively. A t-test showed that, across all trials, unfamiliarity was given significantly more weight than complexity ($t(49) = 2.49$, $p < .01$). This finding is consistent with Hypothesis 1 and the Experiment 2 result that unfamiliarity accounted for nearly twice as much of the variance of the appropriateness judgments than did complexity ($\omega^2 = .005$ and $.003$, respectively).

Irreversibility, significance, and accountability. In describing the decision environment, subjects' mean estimated weights of irreversibility, significance, and accountability were 32.83, 33.28, and 33.76, respectively. These means were not significantly different, although the difference was in the direction predicted in Hypothesis 2 and was consistent with the findings of Experiment 2 ($\omega^2 = .000$, $.003$, and $.004$, respectively).

Decision problem and decision environment. Across all trials, the mean estimated weights of the decision problem and the decision environment were 52.78 and 47.08, respectively. Overall, the decision problem contributed significantly more to strategy selection than did the environment ($t(49) = 2.95$, $p < .005$). This result is consistent with Hypothesis 3 and the finding of Experiment 2 that problem and strategy x problem variables together accounted for slightly more of the appropriateness variance than did the environment and environment x strategy variables ($\omega^2 = .194$ and $.175$, respectively).

When the demands of the decision problem were high, the decision problem was given significantly more weight than the decision environment ($t(49) = 3.76$, $p < .005$). The decision problem was also given more weight than the decision environment when the demands of the decision environment were low ($t(49) = 5.17$, $p < .005$). However, under some conditions the environment was weighted more heavily than the problem. For example, when the demands of

the decision environment were high, the environment contributed significantly more to strategy selection than did the problem (t(49) = 8.42, p < .005). In addition, when the problem demands were low, the environment was weighted significantly higher than the problem (t(49) = 7.06, p < .005). Although the results in these few specific situations ran counter to the hypothesis that the decision problem is perceived as more important than the decision environment, in general, the hypothesis is supported by the findings of Experiment 3.

Overall, then, the hypotheses suggested by the results of Experiment 2 are supported by Experiment 3. It appears that people's perceptions of the relative importance of the decision problem and decision environment variables are consistent with Experiment 2.

Discussion

This series of experiments was designed to test several hypotheses derived from Beach and Mitchell's (in press) contingency model for decision strategy selection. Experiment 1 served as a pilot study. Before the model could be tested it was necessary to determine whether it was possible to manipulate variables of interest. Because judgments of the amount of time, effort, and analysis required to solve the problem increased (1) when the decision's importance increased, and (2) when the problem became irreversible, it was concluded that these variables did indeed affect the perceived demand of the decision problem environment.

The results of Experiment 2 supported all of the tested hypotheses of the model. The decision maker's utility for being correct was an increasing function of the demand of the decision environment. For a given strategy, the judged probability of being correct was a decreasing function of the demand of the decision problem and an increasing function of the degree of formality of the strategy used. Judged cost also was found to be an increasing function of the degree of formality of the strategy used. In addition, judged cost increased as a function of the demands of both the decision problem and the decision environment. Judged appropriateness of the degree of formality of a strategy also was an increasing function of the demands of both the decision problem and the decision environment.

The results of Experiment 2 show that not only did the appropriateness of the formal strategy increase as the demands of the decision problem increased and the appropriateness of the informal strategy decrease as the demands

increased but, also, for decision tasks in which the demand of the decision problem and environment were low, the informal strategy was perceived as more appropriate than the formal one.

Although these findings do not prove any causal relationships among the variables, there is a possible interpretation of the results of Experiment 2 that is consistent with recent research (Friedman & Segev, 1977; Christensen-Szalanski & Beach, 1977; Christensen-Szalanski, 1977). It is possible that at some point, the demand of the decision environment was so low (and thus the utility for solving the problem also was low) and the demand of the decision problem was so low (and thus the probability of being correct was high) that the decision maker was unwilling to expend the large amount of personal resources required to use a formal strategy and could opt for an informal strategy. It is also possible then, that at some point, the demand of the decision environment was so high (and thus the utility for being correct also was high) and the demand of the decision problem was so high (and thus the probability of being correct was low but needed to be as high as possible because of the high utility for being correct) that the decision maker was willing to expend the large amount of personal resources required to use a formal strategy and viewed an informal strategy as inappropriate.

This interpretation is consistent with Friedman and Segev's (1977) economic view of decision making. They prescribe using maximization of profits per unit of time in deciding whether to make a decision or not. The findings of Experiment 2 suggest that people may roughly compute the profitability of using a particular strategy. The concepts of appropriateness and expected net gain (expected profit) are seen as comparable in that they both describe the compromise between the press for making a correct decision and the cost of resources needed for making a correct decision.

This interpretation is consistent with the findings of Christensen-Szalanski and Beach (1977) that imply that the strategy the decision maker sees as offering the greatest expected net gain is the one selected. Christensen-Szalanski (1977) carried this conclusion one step farther to say that people use a form of cost-benefit analysis as a basis for selecting decision strategies and that their behavior is optimal in that it tends to maximize the decision maker's expected net utility.

The results of Experiment 3 are consistent with the findings of Experiment 2 in that (1) of the decision problem variables, unfamiliarity

was judged to be significantly more important than complexity, (2) of the decision environment variables, accountability was judged to be slightly more important than significance, which in turn was judged more important than irreversibility, and (3) overall, the decision problem was considered significantly more important to strategy selection than the decision environment. This last finding may be counter-intuitive to some, and may in fact be due to the way the experiment was conducted. Because the decision problem variables were consistently presented first, a possible primacy effect may have increased the amount of importance given to the decision problem. In addition, the task descriptions were quite abstract, and the subjects may have had difficulty relating to the descriptions of the decision environment. In general, though, people's perceptions of the relative importance of these variables were found to be congruent with the empirical results of Experiment 2.

Although the results of these experiments support the hypotheses tested, the variables involved frequently account for a small percentage of the variance. The relatively large amount of error variance may have several causes. First, it is possible that subjects simply did not understand the tasks. However, this is unlikely because the instructions were given twice and the subjects had an opportunity to ask questions about the tasks.

Individual differences may also account for some of the error variance. Demographic variables (e.g., age, sex, and socioeconomic status) were not included because there was no reason to suspect that they would vary systematically. However, the contingency model for decision strategy selection hypothesized that some individual differences may vary systematically. Those differences include the decision maker characteristics: intelligence, cognitive complexity, characteristic ways of problem solving, and motivation. By including some of these variables in future tests of the model, much of the variance that can now only be attributed to individual differences might be accounted for by specific variables.

A factor which may account for some of the error variance is the degree of reality of the decision tasks. Both Experiments 2 and 3 used very abstract decision tasks that may not have seemed real to the subjects. In addition, the manipulations were built into the task descriptions and were not enacted on the subjects. For example, subjects read that in some cases the decision maker would be held accountable for the outcome of the decision instead of

the subjects' actually having to account to a group for their decisions. McAllister (1978) has shown that the strengths of the decision environment variables are very much influenced by the decision situation. In the McAllister experiment most comparable to the ones described here, the perceived demand of the decision environment was affected most by accountability ($\omega^2 = .17$), slightly less by significance ($\omega^2 = .15$), and considerably less by irreversibility ($\omega^2 = .10$) in contrast to $\omega^2 = .004$, .003, and .000, respectively, in Experiment 2.

Another factor which may contribute to the stronger results of McAllister's (1978) experiments is the type of subjects employed. McAllister used subjects who were full-time managers who were accustomed to making decisions in a business environment in two of his studies, and the results were stronger than those of Experiments 2 and 3 here. Results for his third study, in which the subjects were undergraduate business students, were the weakest of the three. In further studies, using experienced decision makers instead of university students might strengthen the results.

However, even under these conditions where the variables are stronger, they do not account for a very large amount of the variance. Future research should be directed toward finding ways to reduce the amount of error variance. As suggested here, expanding the test of the model to include decision maker characteristics, making the decisions and decision settings more real, and using experienced decision makers as subjects may be ways of reducing the amount of unexplained variance.

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Footnote

Appendix A

Sample Scenario and Scales from Experiment 1

Jason Barth, Inc. is a national firm of golf course architects. Although the organization is only a few years old, it has enjoyed great success and is looking forward to continued growth. You, as financial advisor, have been asked to consider the firm's current investment opportunities and to make recommendations to a newly-created investment committee. The investment program is viewed as a major factor in the firm's growth plan, and, as a relatively new member of the company, you are likely to have to give a detailed justification of your choice to the committee members and the president of the firm.

You and the committee after extensive work, have narrowed the investment decision down to two alternatives. First, the firm can invest in properties in the southwest United States which may become suitable golf course sites as local communities grow. This option offers a very good chance for increased autonomy. If the sites are suitable for development, the architects will have the opportunity to design courses to their own specifications rather than having to work within the limitations set by clients. This makes the job much more enjoyable and satisfying for the architects--an important goal in the company. However, this alternative definitely requires postponing much needed expansion. Because the company has been so successful, it needs larger offices and more staff to meet the demand.

The second alternative is to invest in a new office building. This would make room for extra employees to handle the increasing work load. Expansion will help ensure contined growth of the company. However, choosing this option means that the architects will have to continue to respond to the demands of clients.

Whichever alternative you choose is likely to lead to a long term program. The firm has a record of sticking with the decisions it makes; once committed to a course of action, it follows through and seldom reverses itself.

Given the situational factors surrounding the decision and your knowledge of the different classes of decision strategies please answer the following questions.

How appropriate do you think Rules of Thumb are for solving this decision problem?

Not appropriate   Extremely
                                                                   appropriate

How appropriate do you think the Decision by Scenario strategies are for solving this decision problem?

Hot appropriate   Extremely
                                                                   appropriate

How appropriate do you think the use of a Decision Tool is for solving this decision problem?

Not appropriate   Extremely
                                                                   appropriate

Appendix B

Sample Decision Task from Experiment 2

Case Number ___5114___

Problem is:

    Unfamiliar __X__
    Familiar _____

    Complex _____
    Simple __X__

Environment dictates:

    Irreversibility _____
    Reversibility __X__

    Significance __X__
    Insignificance _____

    Accountability _____
    No accountability __X__

Strategy chosen:

    Informal __X__
    Formal _____

Decision problems require varying amounts of time, effort, and analysis in order to obtain a satisfactory answer. For the above problem, how much time to you think is appropriate?

```
|||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||
  0    10    20    30    40    .50    60    70    80    90    100
```

No time   A great deal
                                                      of time
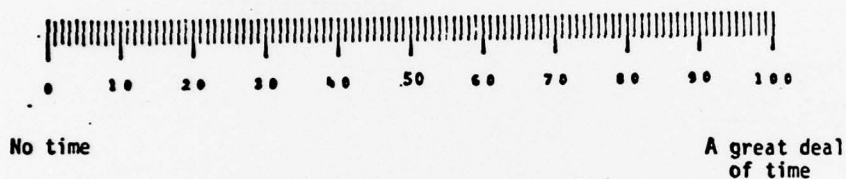
How much effort do you think should be expended on this problem to achieve a satisfactory solution?

```
·||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||
  0    10    20    .30    40    .50    60    70    80    90    100
```

No effort   A great deal
                                                      of effort
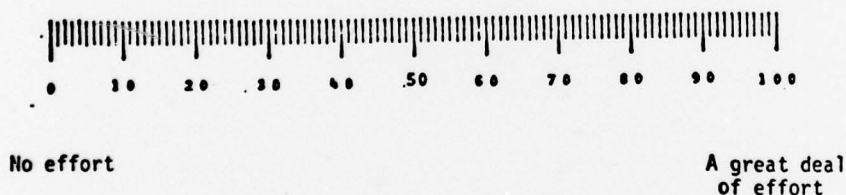
How much analysis do you think is required to obtain a satisfactory answer to this problem?

```
·|||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||||
  0    10    20    30    40    50    60    70    80    90    100
```

No analysis   A great deal
                                                      of analysis

Appendix C

Sample Decision Task and Scales from Experiment 2

Case Number ___5114___

Problem is:

    Unfamiliar ___X___
    Familiar _____

    Complex _____
    Simple ___X___

Environment dictates:
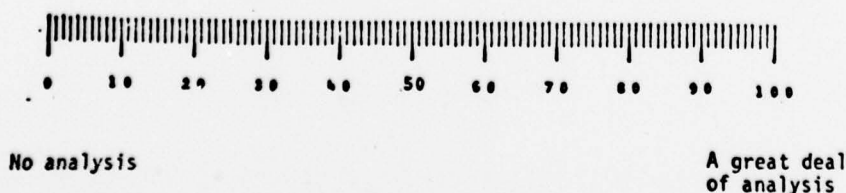
    Irreversibility _____
    Reversibility ___X___

    Significance ___X___
    Insignificance _____

    Accountability _____
    No accountability ___X___
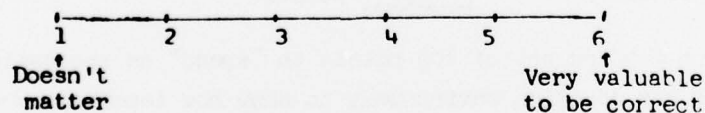
Strategy chosen:

    Informal ___X___
    Formal _____

In your opinion, what is the probability that the decision maker
   was correct in solving the problem?

.00   .10   .20   .30   .40   .50   .60   .70   .80   .90   1.00

Certain he was wrong   Certain he was correct

How valuable is it for the decision maker to have been correct in
    solving this problem?

1   2   3   4   5   6

Doesn't   Very valuable
matter   to be correct

How much do you think it cost in time, money, and effort to solve
    this problem?

1 2 3 4 5 6 7 8 9 10

Very little   Very much
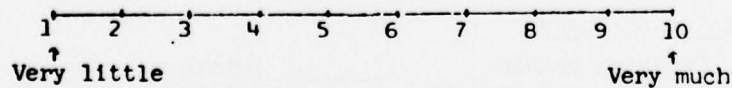
How appropriate do you think the chosen strategy is for solving
    this problem?

0   5   10   15   20

Not at all appropriate   As appropriate as
                               it needs to be
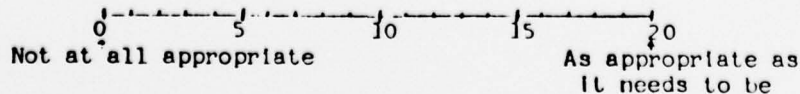
Appendix D

Sample Decision Task from Experiment 3

Case Number __2135__

Problem is:

    Unfamiliar __X__
    Familiar _____

    Complex __X__
    Simple _____

Environment dictates:

    Irreversibility _____
    Reversibility __X__

    Significance __X__
    Insignificance _____

    Accountability __X__
    No accountability _____

1. You have 100 points to "spend" on unfamiliarity and complexity to show how important you think each of those factors is to the decision problem.

    Decision Problem

Unfamiliarity	_____	points
Complexity	_____	points
Total	100	points

2. You have another 100 points to "spend" on irreversibility, significance, and accountability to show how important you think each of these factors is to the decision environment.

    Decision Environment

Irreversibility	_____	points
Significance	_____	points
Accountability	_____	points
Total	100	points

3. You have a third set of 100 points to "spend" on the decision problem and the decision environment to show how important you think each of these categories is to the overall selection of a decision strategy.

    Decision Strategy

Decision problem	_____	points
Decision environment	_____	points
Total	100	points

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